"TECH NOTES"

"TECH NOTES" is an effort by the Headquarters Materials Laboratory to share design and construction technology gained from projects done throughout WSDOT. This issue is from the Pavements Branch and discusses the use of NovaChip® as a possible alternative to a bituminous surface treatment or thin asphalt concrete pavement for pavement surface rehabilitation.

The Use of NovaChip® as a Surface Treatment

Originating in France in the 1980's, NovaChip® is marketed as a pavement rehabilitation, preventive maintenance or surface treatment that has a durable surface with improved skid, wear, and rutting resistance. NovaChip® is a paving process that places a thin gap-graded (3/4 to 3/8 inch) mix (Photo 1) over a liquid membrane, known as Novabond®. Novabond® is a polymer modified emulsion that is specially designed to seal the existing roadway and provide a strong bond with the NovaChip® asphalt material.

Photo 1. NovaChip® asphalt placed as a surface treatment.

The Washington State Department of Transportation (WSDOT) is interested in using NovaChip® as an alternative to Bituminous Surface Treatment (BST). Frequent complaints resulting from BST placements include rough surface texture and flying chips, both during and immediately following construction. To remedy this problem, WSDOT, in general, began placing Asphalt Concrete Pavement (ACP) Class D (open-graded friction course) or ACP Class G (thin dense-graded asphalt) on state highways that pass through small cities. However, due to the raveling problems experienced with ACP Class D friction courses and the shorter overlay life (6 to 10 years) of ACP Class G overlays, a more cost-effective, durable, and maintainable pavement surface is preferred.

Based on reports from other states, NovaChip® may provide the durability and pavement life that WSDOT desires. NovaChip® is placed onto the Novabond® membrane, which provides is an immediate bond of materials, thus eliminating the flying chips experienced with BST seals. The experience in Europe and the United States demonstrates the service life of NovaChip® to be ten years or longer where the asphalt is placed on structurally sound pavements.

Use of NovaChip® on SR 17 through Soap Lake

During August 2001, Koch Pavement Solutions of Spokane, Washington, in conjunction with WSDOT's North Central Regions' Program Management Office, Materials Lab, Project Engineer's Office, Ephrata Maintenance Office, and HQ Materials Lab placed a trial section of NovaChip® on a curbed portion of SR 17 through the City of Soap Lake (Photo 2).

Photo 2. A portion of SR 17 through Soap Lake in eastern Washington prior to the application of NovaChip®.

This portion of SR 17 carries an Average Daily Traffic (ADT) of approximately 4,300 vehicles, 8.5 percent of which is trucks.

Surface Preparation

Prior to the NovaChip® overlay, WSDOT followed Koch Pavement Solution's recommendations that cracks greater than ¼ inch be patched or sealed. Pavement repair was performed to address isolated alligator cracking and potholes. Photos 3 and 4 illustrate typical distresses observed throughout the project.

Photo 3. Cracks of this severity (greater than ¼ inch) should be sealed or repaired prior to the NovaChip® overlay.

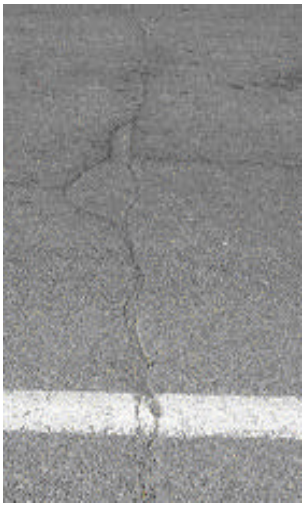

Photo 4. Low severity cracks (less than ¼ inch). Cracks of this severity do not require sealing or repair prior to the NovaChip® overlay.

NovaChip® Placement

Similar to a typical hot-mix asphalt (HMA), NovaChip® is easily produced at a HMA facility and placed with little difficulty. The main difference in the placement of NovaChip® verses typical HMA is the use of a specialized paver, known as the "Novapaver". The Novapaver essentially allows the placement of the Novabond® membrane and NovaChip® surfacing in a single pass. The Novapaver and its basic components are shown in Illustration 1. Unlike a typical HMA paver, a 3,000-gallon emulsion tank is mounted to the Novapaver. Though the Novapaver is much larger than a conventional paving machine, it functions much the same. The Novapaver has an asphalt placement rate of 65 to 75 feet per minute.

Following production of the HMA, standard haul trucks deliver the asphalt to the paver. Once the asphalt is delivered to the paver hopper, a four-auger system delivers material to the rear of the paver where conventional augers distribute the asphalt the full width of the roadway. Just seconds before the paver distributes the hot mix to the roadway, the Novabond membrane is sprayed on the roadway surface. Photos 5 and 6 show the Novabond® emulsion being applied to the existing roadway.

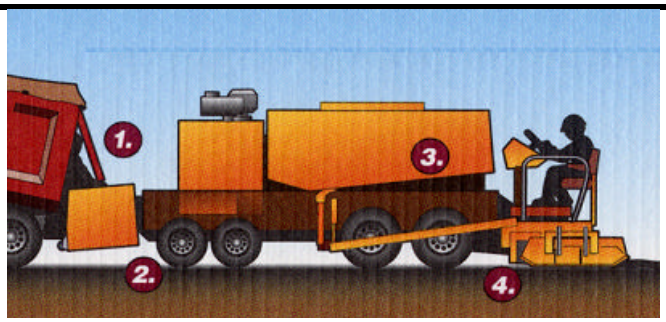

Illustration 1. "The Novapaver"

1. The Novapaver pushes the truck.
2. Material is handled via a four-auger system.
3. Emulsion tank holds the asphalt membrane liquid.
4. Heat from the HMA reacts with the membrane forming a bond between the two materials.

Photo 5. Novabond® emulsion applied just prior to the NovaChip® asphalt.

Photo 6. From left to right - the pre-existing road surface, the Novabond® membrane, and the NovaChip® asphalt.

The project, nearly one mile in length, began on August 7, 2001 with the intent of completing only the northbound lanes. Progress was better than anticipated, and the southbound lanes were completed within a 12-hour day. Photos 7 and 8 show the NovaChip® placement through Soap Lake.

Photo 7. The "Novapaver" is capable of placing the NovaChip® and the Novabond® membrane in a single pass.


Photo 8. Delivery of the NovaChip® asphalt to the Novapaver.

NovaChip® Compaction

The purpose of compaction during NovaChip® placement is to seat the asphalt into the Novabond® membrane rather than to obtain density (Photo 9). Compaction is partially obtained by the vibratory screed of the paver, and then by one or two passes from double drum rollers operating in the static mode (Photos 9 and 10). At Soap Lake, a 15-ton roller was used for the initial breakdown, followed by a 12-ton finish roller. Cross traffic was allowed on the NovaChip® surface approximately 10 to 20 minutes after placement. The finished NovaChip® overlay through Soap Lake is shown in Photo 11.

Photo 9. Compaction should be started immediately after placement and be completed before the mix reaches 195° F.

Photo 10. Compaction was obtained by the use of two static double drum rollers.


Photo 11. Soap Lake's NovaChip® overlay.

Roadways that may be potential candidates for a NovaChip® overlay should have satisfactory structural condition, uniform crown, no patches or potholes that exceed moderate severity, or rutting that exceeds ½ inch. NovaChip® is not intended for use as a leveling course or to fill severe ruts, nor is it designed to bridge weak spots or to cover underlying pavement deficiencies. Potholes and patches should be properly repaired and ruts greater than ½ inch should be milled or leveled prior to NovaChip® surfacing.

Cost Comparison

Since NovaChip® is new to Washington State, prices are based on Koch Pavement Solutions estimates. Nationwide, Koch reports material and placement costs of $4.00 per square yard in the Western United States and $3.50 per square yard in the Eastern United States. These prices are predicated on projects that have 100,000 to 200,000 square yards. As with any paving operation, factors that will influence NovaChip® costs are contractor familiarity and the quantity being placed. The expected material and placement cost in Washington State is from $3.50 to $4.00 per square yard. Table 1 compares the NovaChip® price to traditional WSDOT asphalt bid prices.

Table 1. Range of WSDOT Asphalt Bid Prices for Asphalt Types (material and placement costs).

Asphalt Type	Cost Range ($/Square Yard)
HMA (Class G - 0.08' depth)	1.65 – 2.06
HMA (Class A - 0.15' depth)	2.71 – 3.58
HMA (Class ½ inch Superpave - 0.15' depth)	2.50 – 4.13
NovaChip®	3.50 – 4.00

While the preceding table compares asphalt bid prices (including material and placement costs) on a square yard basis, comparing asphalt types on a project cost basis may be more reasonable. The reason being that individual bid prices do not take into account traffic control, guardrail adjustments, edge mitigation, and utility adjustments, to name a few. For instance, there would be minimal traffic control or guardrail adjustments needed on a typical NovaChip® project.

Table 2 shows project costs comparing BST, NovaChip®, and HMA Class A or ½ inch Superpave. Table 2 shows that the project cost for NovaChip® falls between that of BST and ½ inch Superpave, but similar to a Class G overlay.

Table 2. Range of WSDOT Asphalt Bid Prices for Asphalt Types (material and placement costs).

Rehabilitation Type[1]	Project Cost ($/Lane Mile)	Project Cost ($/Square Yard)
BST	14,000	1.49
HMA (Class G – 0.08' depth)	50,000	5.33
NovaChip®	58,000	6.18
HMA (Class A or ½ inch Superpave - 0.15' depth)[1]	90,000	9.59

1. Based on a rural two-lane highway with two 12-foot lanes and 8-foot shoulders in each direction.

Performance

In May 2003, after twenty-two months of performance, a review of the NovaChip® project was performed. While the overall surface is performing well, some cracks were reflecting through the NovaChip® overlay (Photos 12 and 13).

Photo 12. Transverse crack reflecting through the NovaChip® overlay.

Photo 13. NovaChip in Soap Lake, May 2003.

The Soap Lake project has provided a valuable platform to evaluate the capabilities of this product. NovaChip® asphalt can be placed in one pass, with or without milling, and exhibits an excellent bond to the underlying surface, excellent adhesion (no chip loss), and good skid resistance. Nationwide research has shown that NovaChip® provides reduced rolling noise, and a reduction in hydroplaning and back spray from roadway moisture. Curbs and drainage profiles can be maintained with minimal clearance adjustments due to the thin finished lift.

WSDOT will evaluate the Soap Lake NovaChip® project on a yearly basis, at which time a final report will be written to document the NovaChip's® performance, life cycle costs, and implementation procedures (if applicable). Depending on future research and the resistance to studded tires, NovaChip® could be used as a surface treatment on higher volume routes such as interstate highways and arterials throughout Washington state.

For more information or the complete construction report contact:

Name: Jeff S. Uhlmeyer
Phone: (360) 709-5485
E-mail: uhlmeyj@wsdot.wa.gov